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LAKE NORMAN, CATAWBA, IRADELL, LINCOLN, AND MECKLENBURG COUNTIES, NORTH CAROLINA

Pacific Northwest Environmental Research
Laboratory

PREPARED FOR
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June 1975

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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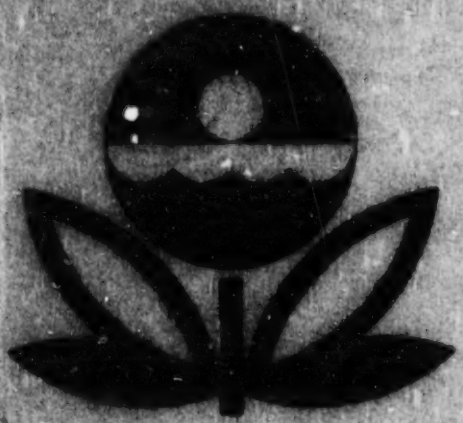

REPORT

ON

LAKE NORMAN

CATAWBA, IREDELL, LINCOLN,

AND MECKLENBURG COUNTIES

NORTH CAROLINA

EPA REGION IV

WORKING PAPER No. 387

PACIFIC NORTHWEST ENVIRONMENTAL RESEARCH LABORATORY

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WITH THE COOPERATION OF THE
NORTH CAROLINA DEPARTMENT OF NATURAL AND ECONOMIC RESOURCES
AND THE
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JUNE, 1975

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the North Carolina Department of Natural and Economic Resources for professional involvement and to the North Carolina National Guard for conducting the tributary sampling phase of the Survey.

Lewis R. Martin, Director of the Division of Environmental Management; Darwin L. Coburn, Chief of the Water Quality Section; and Julian R. Taylor, Supervisor of the Monitoring Program Unit; provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

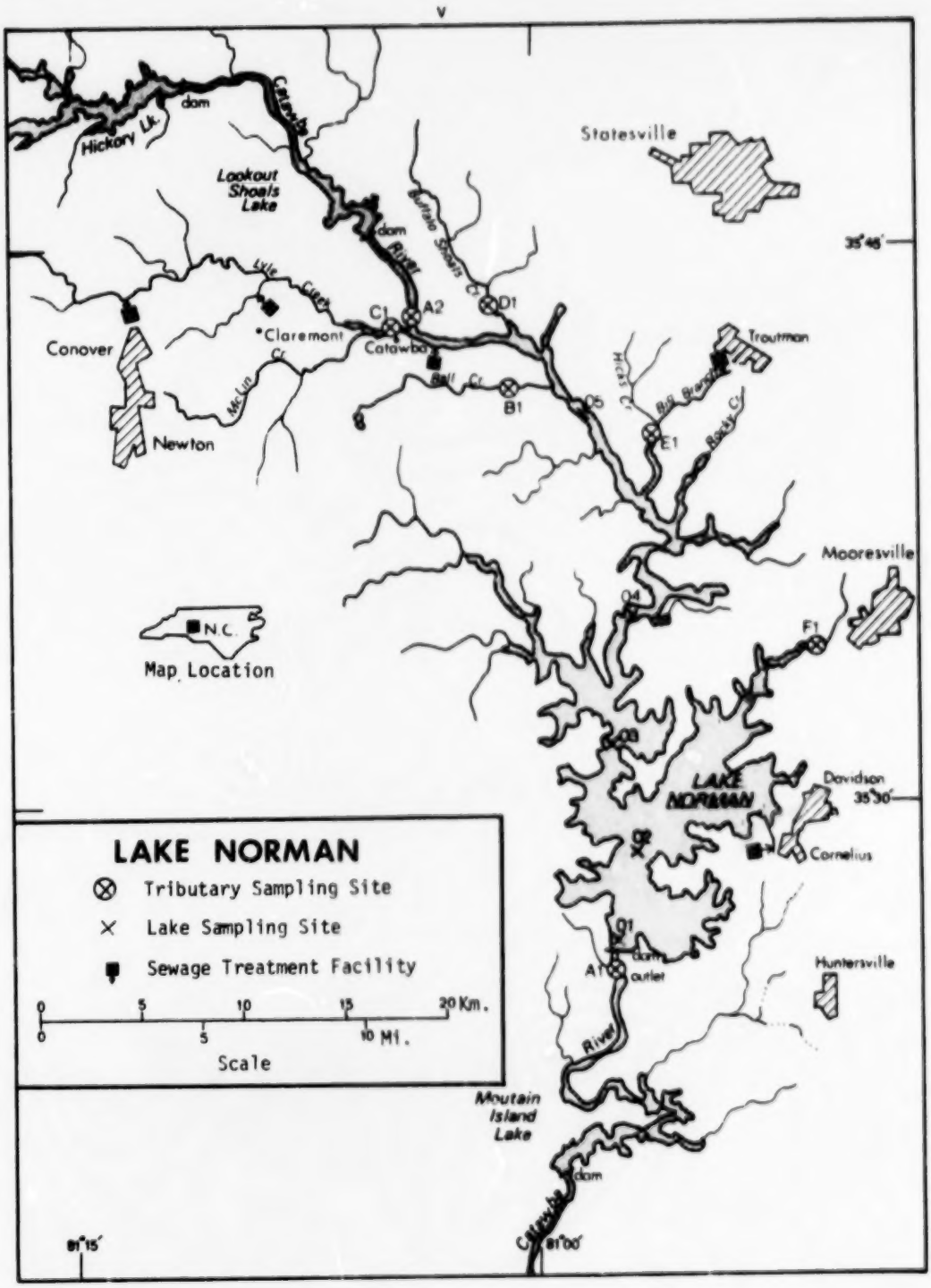
Major General William M. Buck, formerly Adjutant General of North Carolina, and Project Officer Colonel Arthur J. Bouchard, who directed the volunteer efforts of the North Carolina National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF NORTH CAROLINA

LAKE NAME	COUNTY
Badin	Montgomery, Stanly
Blewett Falls	Anson, Richmond
Chatuge	Clay, NC; Towns, GA
Fontana	Graham, Swain
Hickory	Alexander, Caldwell, Catawba
High Rock	Davidson, Rowan
Hiwassee	Cherokee
James	Burke, McDowell
John H. Kerr (Nut Bush Creek)	Granville, Vance, Warren, NC; Halifax, Mecklenburg, VA
Junaluska	Haywood
Lookout Shoals	Alexander, Catawba, Iredell
Mountain Island	Gaston, Mecklenburg
Norman	Catawba, Iredell, Lincoln, Mecklenburg
Rhodhiss	Burke, Caldwell
Santeetlah	Graham
Tillery	Montgomery, Stanly
Waccamaw	Columbus
Waterville	Haywood
Wylie	Gaston, Mecklenburg, NC; York, SC


Hickory Lk.
dam
Catawba River
Lookout Shoals Lake
dam
Statesville
35°45'
Lyle Cr.
Buffalo Shoals Cr.
C1
A2
D1
Conover
*Claremont
Catawba
Troutman
McLin Cr.
Ball Cr.
B1
Hicks Cr.
Big Branch
Rocky Cr.
E1
Newton
Mooresville
N.C.
Map Location
F1
LAKE NORMAN
Davidson
35°30'
Cornelius
LAKE NORMAN
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
0 5 10 15 20 Km.
0 5 10 Mi.
Scale
A1
dam
outlet
Huntersville
River
Moutain Island Lake
dam
Catawba
81°15'
81°00'

LAKE NORMAN

STORET NO. 3713

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Lake Norman is slightly eutrophic. It ranked sixth in overall trophic quality when the 16 North Carolina lakes sampled in 1973 were compared using a combination of six parameters*. Five of the lakes had less and one had the same median total phosphorus, one had less and one had the same median dissolved phosphorus, seven had less median inorganic nitrogen, nine had less mean chlorophyll a, and four had greater Secchi disc transparency.

Survey limnologists noted the absence of emergent vegetation; however, there was marked depression of hypolimnetic dissolved oxygen at all sampling stations in July and at four of the five sampling sites in September.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Lake Norman was limited by phosphorus at the time the sample was collected. The lake data substantiate phosphorus limitation; i.e., the inorganic nitrogen to orthophosphorus ratios were 19 to 1 or greater at all stations and sampling times.

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* See Appendix A.

C. Nutrient Controllability:

1. Point sources--The phosphorus contribution of known point sources amounted to 9.1% of the total input to Norman Lake during the sampling year. The wastewater facilities at Conover and Cornelius accounted for 3.0% and 2.8% of this total, respectively. The wastewater facilities at Troutman, Catawba, and Claremont collectively contributed 3.3% of the total phosphorus load. Septic tanks serving lakeside dwellings, campsites, and parks were estimated to have contributed 0.2% of the total.

The present loading rate of 0.73 $g/m^2/yr$ is slightly less than the rate proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic rate (see page 15). A 50% reduction of the phosphorus contributed by the listed point sources would lower the loading rate to 0.70 $g/m^2/yr$ and should halt any deterioration that may presently be occurring in the lake. A 100% reduction of phosphorus at the known point sources would reduce the loading rate to 0.66 $g/m^2/yr$ and would ensure high water quality in Lake Norman as well as benefit downstream Mountain Island Lake*.

2. Non-point sources--During the sampling year, the phosphorus contribution of non-point sources accounted for

* Working Paper No. 386.

90.7% of the total load. The Catawba River contributed 80.3%, Lyle Creek contributed 1.7%, and the remaining four tributaries collectively contributed 2.5% of the total. The ungaged tributaries were estimated to have contributed 3.7%.

The phosphorus export rates of Hicks Creek and Unnamed Creek F-1 appear to be significantly higher than the rates of the other Lake Norman tributaries (see page 15). The higher rate of Hicks Creek may have resulted from underestimation of the phosphorus contributed by the Troutman wastewater treatment plant, and the higher rate of Unnamed Creek F-1 may be due to urban drainage from Mooresville (1970 population = 8,808).

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Lake Morphometry††:

1. Surface area: 131.57 kilometers^2.
2. Mean depth: 10.2 meters.
3. Maximum depth: 33.5 meters.
4. Volume: 1,348 x 10^6 m^3.
5. Mean hydraulic retention time: 239 days (based on outlet flow).

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Catawba River	3,980.8	63.2
Ball Creek	42.0	0.7
Lyle Creek	183.9	2.6
Buffalo Shoals Creek	54.4	0.7
Hicks Creek	12.9	0.2
Unnamed Creek F-1	12.7	0.2
Minor tributaries & immediate drainage -	217.8	4.8
Totals	4,504.5	72.4

2. Outlet -

Catawba River	4,636.1**	65.2

C. Precipitation***:

1. Year of sampling: 148.9 centimeters.
2. Mean annual: 119.9 centimeters.

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† Table of metric conversions--Appendix B.
†† Park, 1974.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Lake Norman was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from five stations on the lake and from a number of depths at each station (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was composited from the five stations for phytoplankton identification and enumeration; and during the first visit, two 18.9-liter depth-integrated samples were composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 33.5 meters at station 1, 25.3 meters at station 2, 21.6 meters at station 3, 14.6 meters at station 4, and 10.4 meters at station 5.

The lake sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR LAKE NORMAN
STORET CODE 3713

PARAMETER	1ST SAMPLING (3/29/73) 5 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (7/11/73) 5 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (9/19/73) 5 SITES RANGE	MEAN	MEDIAN
TEMP (C)	[illegible]	[illegible]	[illegible]	13.1 - 31.1	22.8	23.0	14.1 - 30.2	24.9	26.1
DISS OXY (MG/L)	[illegible]	[illegible]	[illegible]	1.2 - [illegible]	4.0	2.6	0.2 - 8.0	4.1	5.0
CNDCTVY (MCHOMO)	56. - 73.	55.	55.	39. - 61.	46.	46.	51. - 68.	57.	58.
PH (STAND UNITS)	[illegible]	[illegible]	[illegible]	6.2 - [illegible]	6.9	6.4	6.1 - 7.2	6.4	6.3
TOT ALK (MG/L)	10. - 11.	10.	10.	14. - 29.	20.	21.	11. - 22.	16.	16.
TOT P (MG/L)	[illegible]	[illegible]	[illegible]	0.009 - 0.045	0.017	0.013	0.004 - 0.032	0.011	0.010
ORTHO P (MG/L)	[illegible]	[illegible]	[illegible]	0.002 - 0.008	0.003	0.003	0.003 - 0.010	0.006	0.006
NO2+NO3 (MG/L)	[illegible]	[illegible]	[illegible]	0.060 - 0.480	0.244	0.210	0.020 - 0.220	0.102	0.115
AMMONIA (MG/L)	[illegible]	[illegible]	[illegible]	0.060 - 0.240	0.099	0.090	0.020 - 0.200	0.091	0.060
KJEL N (MG/L)	[illegible]	[illegible]	[illegible]	0.200 - 1.400	0.500	0.300	0.200 - 1.000	0.483	0.400
INORG N (MG/L)	[illegible]	[illegible]	[illegible]	0.140 - 0.590	0.343	0.360	0.060 - 0.370	0.183	0.175
TOTAL N (MG/L)	[illegible]	[illegible]	[illegible]	0.360 - 2.330	0.744	0.630	0.280 - 1.040	0.586	0.530
CHLRPYL A (UG/L)	[illegible]	[illegible]	[illegible]	2.4 - [illegible]	3.6	3.9	2.8 - 13.5	7.0	5.6
SECCHI (METERS)	[illegible]	[illegible]	[illegible]	1.3 - 2.7	2.0	1.8	0.9 - 1.8	1.6	1.7

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal units per ml
03/29/73	1. Melosira	1,178
	2. Flagellates	1,047
	3. Navicula	58
	4. Scenedesmus	15
	5. Treubaria	15
	Other genera	57
	Total	2,370
07/11/73	1. Flagellates	1,268
	2. Melosira	412
	3. Cyclotella	191
	4. Peridinium	118
	5. Pennate diatoms	118
	Other genera	443
	Total	2,550
09/19/73	1. Dactyloccopsis	854
	2. Flagellates	438
	3. Synedra	188
	4. Peridinium	188
	5. Cyclotella	66
	Other genera	433
	Total	2,167

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
03/29/73	01	9.1
	02	8.4
	03	7.8
	04	4.4
	05	4.5
07/11/73	01	4.4
	02	3.9
	03	4.2
	04	2.4
	05	3.1
09/19/73	01	7.8
	02	5.6
	03	5.2
	04	2.8
	05	13.5

C. Limiting Nutrient Study:

1. Stations 1, 2, and 3 -

a. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.008	0.296	0.1
0.050 P	0.058	0.296	6.7
0.050 P + 1.0 N	0.058	1.296	23.2
1.0 N	0.008	1.296	0.1

b. Filtered and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.010	0.366	0.4
0.050 P	0.060	0.366	7.4
0.050 P + 1.0 N	0.060	1.366	18.3
1.0 N	0.010	1.366	0.4

2. Stations 4 and 5 -

a. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.016	0.352	2.3
0.050 P	0.066	0.352	7.3
0.050 P + 1.0 N	0.066	1.352	27.3
1.0 N	0.016	1.352	2.0

b. Filtered and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.015	0.365	2.3
0.050 P	0.065	0.365	8.0
0.050 P + 1.0 N	0.065	1.365	23.9
1.0 N	0.015	1.365	2.1

3. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential primary productivity of Lake Norman was moderate at stations 1, 2, and 3 and moderately high at stations 4 and 5 at the time the samples were collected. Also, a significant increase in yield in

all assays when orthophosphorus was added indicates that the lake was limited by phosphorus at that time. Note that in all assays the addition of only nitrogen resulted in a yield no greater than the control yield.

The differences shown by the control yields at stations 1, 2, and 3 (central and south end of lake) and at stations 4 and 5 (north end of lake) indicate the differences in availability of nutrients for primary production. Note that orthophosphorus concentrations were 1½ to 2 times greater at stations 4 and 5 than at stations 1, 2, and 3.

The lake data substantiate phosphorus limitation; i.e., the mean inorganic nitrogen to orthophosphorus ratios were 19 to 1 or greater at all stations and sampling times, and phosphorus limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the North Carolina National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of January and February when two samples were collected. Sampling was begun in March, 1973, and was completed in February, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the North Carolina District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads shown are those measured minus point-source loads, if any.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the means of the nutrient loads, in $kg/km^2/year$, at stations B-1 and D-1 and multiplying the means by the ZZ area in km^2.

The operators of the Conover, Troutman, and Cornelius wastewater treatment plants provided monthly effluent samples and corresponding flow data. However, the operators of the Claremont and Catawba

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* See Working Paper No. 175.

wastewater treatment plants did not participate in the sampling program, and nutrient loads were estimated at 1.134 P and 3.401 N/capita/year.

A. Waste Sources:

1. Known municipal -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Conover*	2,606	act. sludge	1,158.2	Lyle Creek
Troutman*	800	act. sludge	246.0	Big Branch
Cornelius*	1,295	trickling filter	719.2	Unnamed Creek/ Lake Norman
Catawba**	1,100	primary clarifier	416.4***	Lyle Creek
Claremont -				
N. Plant**	788	extended aer.	298.3***	Lyle Creek
S. Plant**			298.3***	Coulter Branch/ Lyle Creek

2. Known industrial - None

* Treatment plant questionnaires.
** Anonymous, 1971.
*** Estimated at 0.3785 m^3/capita/day.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Catawba River	77,020	80.3
Ball Creek	785	0.8
Lyle Creek	1,670	1.7
Buffalo Shoals Creek	745	0.8
Hicks Creek	410	0.4
Unnamed Creek F-1	500	0.5
b. Minor tributaries & immediate drainage (non-point load) -	3,595	3.7
c. Known municipal STP's -		
Conover	2,890	3.0
Troutman	1,030	1.1
Cornelius	2,710	2.8
Catawba	1,245	1.3
Claremont-N. Plant	445	0.5
Claremont-S. Plant	445	0.5
d. Septic tanks* -	200	0.2
e. Known industrial - None	-	-
f. Direct precipitation** -	2,300	2.4
Total	95,990	100.0

2. Outputs -

Lake outlet - Catawba River 30,965

3. Net annual P accumulation - 65,025 kg.

* Estimate based on 600 lakeside dwellings, 15 campsites, and 1 park; see Working Paper No. 175.
** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Catawba River	1,377,940	77.3
Ball Creek	30,300	1.7
Lyle Creek	64,215	3.6
Buffalo Shoals Creek	16,630	0.9
Hicks Creek	3,355	0.2
Unnamed Creek F-1	5,080	0.3
b. Minor tributaries & immediate drainage (non-point load) -	111,840	6.3
c. Known municipal STP's -		
Conover	5,845	0.3
Troutman	1,880	0.1
Cornelius	9,615	0.5
Catawba	3,740	0.2
Claremont-N. Plant	1,340	0.1
Claremont-S. Plant	1,340	0.1
d. Septic tanks* -	7,495	0.4
e. Known industrial - None	-	-
f. Direct precipitation** -	142,045	8.0
Total	1,782,660	100.0

2. Outputs -

Lake outlet - Catawba River 1,617,200

3. Net annual N accumulation - 165,460 kg.

* Estimate based on 600 lakeside dwellings, 15 campsites, and 1 park; see Working Paper No. 175.
** See Working Paper No. 175.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km²/yr	kg N/km²/yr
Catawba River	19	346
Ball Creek	19	721
Lyle Creek	9	349
Buffalo Shoals Creek	14	306
Hicks Creek	32	260
Unnamed Creek F-1	39	400

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m²/yr	0.73	0.49	13.5	1.3

Vollenweider loading rates for phosphorus (g/m²/yr) based on mean depth and mean hydraulic retention time of Lake Norman:

"Dangerous" (eutrophic rate)	0.76
"Permissible" (oligotrophic rate)	0.38

V. LITERATURE REVIEWED

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VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	3719	LAKE WACCAMAW	534
2	3716	SANTEELAH LAKE	446
3	3711	MOUNTAIN ISLAND LAKE	419
4	3707	HIWASSEE LAKE	414
5	3704	FONTANA LAKE	392
6	3713	LAKE NORMAN	346
7	3708	LAKE JAMES	334
8	3710	LOOKOUT SHOALS	327
9	3715	RHODHISS LAKE	296
10	3705	LAKE HICKORY	283
11	3717	LAKE TILLERY	246
12	3709	LAKE JUNALUSKA	220
13	3702	BLEWETT FALLS LAKE	200
14	3718	WATERVILLE RESERVOIR	140
15	3701	BADIN LAKE	124
16	3706	HIGH ROCK LAKE	76

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500- MEAN SEC	MEAN CHLORA	15- MIN DO	MEDIAN DISS ORTHO P
3701	BADIN LAKE	0.042	0.680	466.750	7.190	14.900	0.012
3702	BLEWETT FALLS LAKE	0.090	0.655	476.889	4.167	10.800	0.034
3704	FONTANA LAKE	0.011	0.550	392.650	3.438	14.900	0.007
3705	LAKE HICKORY	0.047	0.320	461.000	7.275	13.400	0.008
3706	HIGH ROCK LAKE	0.090	0.580	477.454	14.283	14.800	0.017
3707	HIWASSEE LAKE	0.015	0.240	420.555	5.678	14.200	0.007
3708	LAKE JAMES	0.020	0.160	428.666	7.660	14.800	0.006
3709	LAKE JUNALUSKA	0.031	0.560	462.000	7.233	14.200	0.009
3710	LOOKOUT SHOALS	0.026	0.370	459.167	4.200	13.800	0.008
3711	MOUNTAIN ISLAND LAKE	0.018	0.270	462.000	5.580	12.800	0.005
3713	LAKE NORMAN	0.019	0.330	446.667	5.807	14.800	0.005
3715	RHODHISS LAKE	0.061	0.305	462.111	3.578	13.600	0.019
3716	SANTEELAH LAKE	0.011	0.160	366.400	5.360	14.800	0.006
3717	LAKE TILLERY	0.040	0.470	468.500	6.827	13.600	0.008
3718	WATERVILLE RESERVOIR	0.103	0.860	468.333	3.817	14.400	0.041
3719	LAKE WACCAMAW	0.018	0.120	455.667	3.583	9.800	0.004

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
3701	BADIN LAKE	33 (5)	7 (1)	27 (4)	27 (4)	3 (0)	27 (4)	124
3702	BLEWETT FALLS LAKE	7 (1)	13 (2)	7 (1)	73 (11)	93 (14)	7 (1)	200
3704	FONTANA LAKE	100 (15)	33 (5)	93 (14)	100 (15)	3 (0)	63 (9)	392
3705	LAKE HICKORY	27 (4)	60 (9)	53 (8)	13 (2)	80 (12)	50 (7)	283
3706	HIGH ROCK LAKE	13 (2)	20 (3)	0 (0)	0 (0)	23 (2)	20 (3)	76
3707	HIWASSEE LAKE	87 (13)	80 (12)	87 (13)	47 (7)	50 (7)	63 (9)	414
3708	LAKE JAMES	60 (9)	87 (13)	80 (12)	7 (1)	23 (2)	77 (11)	334
3709	LAKE JUNALUSKA	47 (7)	27 (4)	43 (6)	20 (3)	50 (7)	33 (5)	220
3710	LOOKOUT SHOALS	53 (8)	47 (7)	60 (9)	67 (10)	60 (9)	40 (6)	327
3711	MOUNTAIN ISLAND LAKE	73 (11)	73 (11)	43 (6)	53 (8)	87 (13)	90 (13)	419
3713	LAKE NORMAN	67 (10)	53 (8)	73 (11)	40 (6)	23 (2)	90 (13)	346
3715	RHODHISS LAKE	20 (3)	67 (10)	33 (5)	93 (14)	70 (10)	13 (2)	296
3716	SANTEELAH LAKE	93 (14)	93 (14)	100 (15)	60 (9)	23 (2)	77 (11)	446
3717	LAKE TILLERY	40 (6)	40 (6)	13 (2)	33 (5)	70 (10)	50 (7)	246
3718	WATERVILLE RESERVOIR	0 (0)	0 (0)	20 (3)	80 (12)	40 (6)	0 (0)	140
3719	LAKE WACCAMAW	80 (12)	100 (15)	67 (10)	87 (13)	100 (15)	100 (15)	534

APPENDIX B

CONVERSIONS FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR NORTH CAROLINA 10/21/75

LAKE CODE 3713 LAKE NORMAN

TOTAL DRAINAGE AREA OF LAKE(SQ MI) 1790.00

TRIBUTARY	SUB-DRAINAGE AREA(SQ MI)	NORMALIZED FLOWS(CFS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3713A1	1790.00	2910.00	2100.00	1920.00	1860.00	2170.00	2470.00	2140.00	2110.00	2460.00	2500.00	2780.00	2200.00	2302.33
3713A2	1537.00	2460.00	2600.00	2850.00	2210.00	2140.00	2060.00	1810.00	2000.00	1810.00	2250.00	2120.00	2490.00	2232.33
3713B1	16.20	28.00	37.00	38.00	35.00	25.00	22.00	17.00	20.00	20.00	21.00	19.00	24.00	25.42
3713C1	71.00	115.00	146.00	148.00	120.00	84.00	75.00	66.00	57.00	70.00	70.00	74.00	95.00	92.99
3713D1	21.00	24.00	34.00	36.00	40.00	24.00	21.00	17.00	15.00	16.00	17.00	16.00	22.00	23.42
3713E1	5.00	6.20	8.20	8.50	8.20	5.20	4.60	3.90	3.50	3.80	4.00	4.00	6.10	5.50
3713F1	4.90	7.60	8.10	8.30	6.70	4.60	4.20	3.60	3.10	3.80	3.80	4.10	6.70	5.37
3713ZZ	135.00	194.00	256.00	270.00	246.00	158.00	146.00	119.00	115.00	120.00	131.00	121.00	177.00	170.53

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1790.00
SUM OF SUB-DRAINAGE AREAS = 1790.10

TOTAL FLOW IN = 30691.76
TOTAL FLOW OUT = 27620.00

MEAN MONTHLY FLOWS AND DAILY FLOWS(CFS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3713A1	3	73	6300.00	25	4280.00				
	4	73	6390.00	15	1160.00				
	5	73	5270.00	19	128.00				
	6	73	4270.00	23	128.00				
	7	73	3630.00	24	1320.00				
	8	73	3690.00	18	128.00				
	9	73	3340.00	15	575.00				
	10	73	1720.00	21	128.00				
	11	73	2190.00	17	1150.00				
	12	73	2560.00	15	6340.00				
	1	74	3520.00	6	1670.00	19	1090.00		
	2	74	3980.00	3	2410.00	16	5080.00		
3713A2	3	73	6940.00	25	5050.00				
	4	73	5480.00	15	2440.00				
	5	73	5250.00	19	500.00				
	6	73	3700.00	23	2230.00				
	7	73	2650.00	24	2300.00				
	8	73	3300.00	18	3080.00				
	9	73	2270.00	15	3260.00				
	10	73	2000.00	21	175.00				
	11	73	1560.00	17	1350.00				
	12	73	3260.00	15	6450.00				
	1	74	4300.00	6	1870.00	19	1200.00		
	2	74	3600.00	3	2650.00	16	4570.00		

TRIBUTARY FLOW INFORMATION FOR NORTH CAROLINA 10/21/75

LAKE CODE 3713 LAKE NORMAN

MEAN MONTHLY FLOWS AND DAILY FLOWS(CFS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
371301	3	73	76.00	25	54.00				
	4	73	62.00	15	43.00				
	5	73	50.00	19	34.00				
	6	73	35.00	23	36.00				
	7	73	24.00	24	24.00				
	8	73	21.00	18	22.00				
	9	73	15.00	15	21.00				
	10	73	17.00	21	12.00				
	11	73	14.00	17	12.00				
	12	73	42.00	16	22.00				
	1	74	50.00	6	37.00	19	21.00		
	2	74	40.00	3	45.00	16	35.00		
3713C1	3	73	230.00	25	170.00				
	4	73	260.00	15	135.00				
	5	73	165.00	19	115.00				
	6	73	115.00	23	115.00				
	7	73	70.00	24	75.00				
	8	73	75.00	18	150.00				
	9	73	50.00	15	65.00				
	10	73	55.00	21	45.00				
	11	73	45.00	17	45.00				
	12	73	150.00	16	73.00				
	1	74	150.00	6	125.00	19	70.00		
	2	74	125.00	3	135.00	16	100.00		
371301	3	73	68.00	25	49.00				
	4	73	70.00	15	40.00				
	5	73	54.00	19	34.00				
	6	73	34.00	23	34.00				
	7	73	23.00	24	22.00				
	8	73	20.00	18	80.00				
	9	73	15.00	15	19.00				
	10	73	16.00	21	13.00				
	11	73	16.00	17	13.00				
	12	73	45.00	16	21.00				
	1	74	40.00	6	37.00	19	21.00		
	2	74	37.00	3	40.00	16	30.00		
3713E1	3	73	16.00	25	13.00				
	4	73	19.00	15	11.00				
	5	73	14.00	19	8.00				
	6	73	8.50	23	9.00				
	7	73	5.60	24	5.40				
	8	73	5.50	18	7.50				
	9	73	4.00	15	5.40				
	10	73	4.20	21	3.80				
	11	73	3.90	17	3.70				
	12	73	10.00	16	5.70				
	1	74	12.00	6	10.00	19	5.50		
	2	74	10.00	3	15.00	16	9.00		

TRIBUTARY FLOW INFORMATION FOR NORTH CAROLINA 10/21/75

LAKE CODE 3713 LAKE NORMAN

MEAN MONTHLY FLOWS AND DAILY FLOWS(CFS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3713F1	3	73	19.00	25	13.00				
	4	73	17.00	15	10.00				
	5	73	14.00	19	7.80				
	6	73	8.30	23	8.00				
	7	73	5.50	24	5.30				
	8	73	5.40	18	5.30				
	9	73	3.90	15	5.20				
	10	73	4.10	21	3.70				
	11	73	3.80	17	3.50				
	12	73	9.90	16	5.60				
	1	74	12.00	6	9.60	19	5.30		
	2	74	10.00	3	14.00	16	8.80		
3713ZZ	3	73	430.00						
	4	73	470.00						
	5	73	300.00						
	6	73	200.00						
	7	73	100.00						
	8	73	90.00						
	9	73	95.00						
	10	73	95.00						
	11	73	80.00						
	12	73	270.00						
	1	74	350.00						
	2	74	280.00						

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/10/20

371301
35 26 20.0 080 57 00.0
LAKE NORMAN
37119 NORTH CAROLINA

11EPALES 2111202
3 0111 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/29	10 10	0000	12.5		32	55	7.20	10K	0.050	0.200	0.280	0.003
	10 10	0006	12.5	10.4		55	7.20	10K	0.040	0.200	0.270	0.004
	10 10	0015	12.5	10.4		50	7.20	10K	0.050	0.200K	0.280	0.004
	10 10	0025	12.4	10.2		55	7.00	10	0.040	0.200K	0.270	0.003
	10 10	0040	11.8	10.0		58	7.10	11	0.050	0.200K	0.280	0.003
	10 10	0060	10.4	10.0		58	7.30	10	0.040	0.200K	0.280	0.005
	10 10	0075	9.9	9.4		60	7.00	10	0.050	0.200K	0.310	0.006
	10 10	0090	9.6	9.0		60	7.10	11	0.050	0.200K	0.320	0.004
	10 10	0107	9.6	9.0		60	7.10	10	0.050	0.200K	0.320	0.005
73/07/11	13 40	0000	29.8	9.2	106	61	8.60	22	0.090	0.600	0.080	0.008
	13 40	0005	29.7	8.8		57						
	13 40	0012	29.6	8.5		56	7.70	19	0.070	0.300	0.060	0.003
	13 40	0015	28.9	8.7		50						
	13 40	0021	26.3	5.6		48	6.30	19	0.090	0.300	0.170	0.002
	13 40	0030	22.2	2.3		41						
	13 40	0040	20.7	1.7		41						
	13 40	0050	18.3	1.7		41	6.30	21	0.080	0.200K	0.360	0.003
	13 40	0060	16.1	2.5		40						
	13 40	0070	14.7	2.7		40						
	13 40	0080	14.1	3.5		39						
	13 40	0090	13.9	3.4		40	6.30	22	0.080	1.900	0.430	0.002
	13 40	0100	13.4	2.4		40						
	13 40	0110	13.1	1.5		42	6.30	24	0.110	0.300	0.480	0.002
73/09/19	09 20	0000	26.4	7.2	72	51	6.70	17	0.040	1.000	0.040	0.007
	09 20	0015	26.4	7.2		54	6.80	16	0.020	0.400	0.040	0.006
	09 20	0035	26.3	7.0		52	6.50	16	0.040	0.400	0.040	0.005
	09 20	0060	20.8	0.2		52	6.20	19	0.100	0.300	0.140	0.003
	09 20	0080	15.8	0.4			6.10	21	0.180	0.600	0.120	0.004
	09 20	0100	14.1	0.4			6.20	22	0.180	0.600	0.190	0.004

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/20

371301
35 26 20.0 080 57 00.0
LAKE NORMAN
37119 NORTH CAROLINA

11EPALES 2111202
3 0111 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/29	10 10	0000	0.230	9.1
	10 10	0006	0.031	
	10 10	0015	0.037	
	10 10	0025	0.019	
	10 10	0040	0.019	
	10 10	0060	0.016	
	10 10	0075	0.020	
	10 10	0090	0.026	
	10 10	0107	0.027	
73/07/11	13 40	0000	0.013	4.4
	13 40	0012	0.010	
	13 40	0021	0.009	
	13 40	0050	0.009	
	13 40	0090	0.012	
	13 40	0110	0.019	
73/09/19	09 20	0000	0.012	7.8
	09 20	0015	0.011	
	09 20	0035	0.010	
	09 20	0060	0.006	
	09 20	0080	0.028	
	09 20	0100	0.005	

STORET RETRIEVAL DATE 75/10/20

371302
35 29 45.0 080 56 45.0
LAKE NORMAN
37119 NORTH CAROLINA

11EPALES
3

2111202
0087 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/29	11	30 0000	12.5		20	60	7.10	10K	0.080	0.400	0.340	0.005
	11	30 0006	12.5	10.0		60	7.10	10K	0.050	0.300	0.280	0.005
	11	30 0015	12.4	9.8		73	6.90	10K	0.060	0.200	0.280	0.004
	11	30 0025	12.2	7.8		52	6.80	10K	0.060	0.200K	0.280	0.005
	11	30 0045	11.1	9.6		58	6.60	11	0.060	0.200K	0.300	0.007
	11	30 0065	10.4	9.6		55	7.20	10K	0.050	0.200K	0.300	0.004
	11	30 0083	9.9	9.0		60	7.20	10K	0.060	0.200K	0.330	0.004
73/07/11	14	35 0000	30.1	9.1	96	60	8.30	22	0.080	0.500	0.080	0.003
	14	35 0005	29.9	8.6		58						
	14	35 0012	29.0	8.0		55	7.30	22	0.080	0.300	0.100	0.002
	14	35 0015	28.2	7.6		53						
	14	35 0020	26.0	3.9		49	6.40	23	0.100	0.300	0.200	0.002
	14	35 0030	23.0	2.1		42						
	14	35 0040	21.1	1.5		42						
	14	35 0050	19.4	1.4		42	6.30	24	0.070	0.200K	0.340	0.002
	14	35 0060	16.0	1.8		41						
	14	35 0070	14.6	1.4		42						
	14	35 0075	14.3	1.2		42	6.20	24	0.110	0.200	0.430	0.002
73/09/19	10	15 0000	26.1	7.2	72	53	6.50	20	0.050	0.600	0.070	0.009
	10	15 0015	26.1	6.4		56	6.40	12	0.040	0.400	0.060	0.006
	10	15 0030	26.1	5.0		51	6.40	11	0.040	0.400	0.060	0.005
	10	15 0051	23.7	0.4		58	6.20	15	0.140	0.600	0.020K	0.005

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/20

371302
35 29 45.0 080 56 45.0
LAKE NORMAN
371) , NORTH CAROLINA

11EPALES 2111202
3 0087 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/29	11 30	0000	0.039	8.4
	11 30	0006	0.036	
	11 30	0015	0.035	
	11 30	0025	0.027	
	11 30	0045	0.020	
	11 30	0065	0.021	
	11 30	0083	0.026	
73/07/11	14 35	0000	0.012	3.9
	14 35	0012	0.009	
	14 35	0020	0.009	
	14 35	0050	0.011	
	14 35	0075	0.017	
73/09/19	10 15	0000	0.008	5.6
	10 15	0015	0.006	
	10 15	0030	0.006	
	10 15	0051	0.006	

STORET RETRIEVAL DATE 75/10/20

371303
35 31 30.0 080 57 30.0
LAKE NORMAN
37119 NORTH CAROLINA

11EPALES
3

2111202
0075 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/29	14 10	0000	13.3		20	50	7.20	10K	0.090	0.700	0.290	0.008
	14 10	0006	13.2	9.9		50	7.20	10K	0.060	0.300	0.280	0.006
	14 10	0015	13.2	9.8		50	7.20	10K	0.070	0.300	0.280	0.008
	14 10	0025	12.1	9.2		50	7.20	10K	0.090	0.300	0.280	0.011
	14 10	0040	11.6	9.0		52	7.10	10K	0.080	0.200	0.300	0.008
	14 10	0055	10.4	9.0		52	7.10	10K	0.070	0.200	0.340	0.007
	14 10	0071	10.1	8.6		52	7.10	10K	0.070	0.300	0.380	0.008
73/07/11	15 20	0000	30.2	9.2	72	60	8.10	21	0.090	0.600	0.130	0.004
	15 20	0005	29.6	7.5		56						
	15 20	0010	29.3	6.6		55						
	15 20	0015	27.8	4.5		54	6.30	23	0.100	0.300	0.200	0.002
	15 20	0020	25.9	2.8		50						
	15 20	0025	24.5	2.6		46						
	15 20	0030	22.9	1.9		45	6.30	23	0.070	0.300	0.340	0.002
	15 20	0035	22.2	1.4		43						
	15 20	0040	20.9	1.4		43						
	15 20	0045	19.5	1.4		42						
	15 20	0050	18.5	1.5		43	6.30	24	0.070	0.200	0.350	0.002
	15 20	0055	16.9	1.8		44						
	15 20	0060	16.2	1.9		42						
	15 20	0065	14.9	1.9		43	6.30	25	0.090	1.800	0.410	0.002
	15 20	0067	14.7	1.8		43						
73/09/19	10 50	0000	26.7	5.6	65	58	6.50	13	0.060	0.800	0.120	0.008
	10 50	0010	26.7	5.4		61	6.50	13	0.060	0.400	0.120	0.004
	10 50	0025	26.4	5.0		58	6.30	13	0.050	0.300	0.120	0.004
	10 50	0040	25.9	2.4		58	6.20	14	0.060	0.300	0.110	0.006
	10 50	0057	20.7	0.2		60	6.20	18	0.200	0.400	0.020K	0.005

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/20

371303
35 31 30.0 080 57 30.0
LAKE NORMAN
37119 NORTH CAROLINA

11EPALES 2111202
3 0075 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/29	14 10	0000	0.048	7.8
	14 10	0006	0.039	
	14 10	0015	0.046	
	14 10	0025	0.044	
	14 10	0040	0.041	
	14 10	0055	0.036	
	14 10	0071	0.069	
73/07/11	15 20	0000	0.013	4.2
	15 20	0015	0.012	
	15 20	0030	0.013	
	15 20	0050	0.009	
	15 20	0065	0.020	
73/09/19	10 50	0000	0.010	5.2
	10 50	0010	0.006	
	10 50	0025	0.005	
	10 50	0040	0.006	
	10 50	0057	0.004	

STORET RETRIEVAL DATE 75/10/20

371304
35 35 10.0 080 56 20.0
LAKE NORMAN
37119 NORTH CAROLINA

11EPALES 2111202
3 0052 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/29	15	0000	19.5		18	55	7.10	10K	0.120	0.300	0.280	0.010
	15	0006	15.6	9.5		55	7.10	10K	0.090	0.200K	0.270	0.010
	15	0015	12.8	9.6		55	7.10	10K	0.100	0.400	0.200	0.012
	15	0022	12.4	9.5		55	7.10	10K	0.110	0.300	0.280	0.014
	15	0035	12.0	9.2		55	7.10	10K	0.120	0.300	0.280	0.014
	15	0048	11.1	8.8		55	7.10	10K	0.120	0.300	0.300	0.013
73/07/11	16	0000	31.1		50	59	6.90	16	0.110	0.600	0.180	0.004
	16	0005	29.6	3.6		60	6.50	18	0.110	0.500	0.280	0.004
	16	0015	27.7	3.0		55	6.40	18	0.130	0.200K	0.290	0.003
	16	0030	24.0	2.6		55	6.30	17	0.130	0.200K	0.230	0.003
	16	0045	19.7	2.4		55	6.30	17	0.060	0.200K	0.350	0.003
73/09/19	11	0000	30.2	3.0	65	68	6.30	17	0.140	0.600	0.130	0.006
	11	0005	28.1	3.4		62	6.30	17	0.080	0.400	0.170	0.005
	11	0010	26.8	3.2		60	6.30	17	0.060	0.300	0.180	0.006
	11	0025	26.2	1.0		59	6.20	17	0.050	0.400	0.220	0.009
	11	0042	25.5	0.3		61	6.30	18	0.100	0.400	0.140	0.006

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/20

371304
35 35 10.0 080 56 20.0
LAKE NORMAN
37119 NORTH CAROLINA

11EPALES 2111202
3 0052 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/29	15 00	0000	0.049	4.4
	15 00	0006	0.045	
	15 00	0015	0.043	
	15 00	0022	0.045	
	15 00	0035	0.045	
	15 00	0048	0.047	
73/07/11	16 40	0000	0.017	2.4
	16 40	0005	0.017	
	16 40	0015	0.018	
	16 40	0030	0.022	
	16 40	0045	0.030	
73/09/19	11 35	0000	0.012	2.8
	11 35	0005	0.010	
	11 35	0010	0.008	
	11 35	0025	0.011	
	11 35	0042	0.011	

STORET RETRIEVAL DATE 75/10/20

371305
35 41 30.0 080 58 00.0
LAKE NORMAN
37119 NORTH CAROLINA

11EPALES 2111202
3 0038 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/29	15 40	0000	13.3		15	50K	7.20	10K	0.100	0.300	0.280	0.010
	15 40	0006	12.9	9.1		50K	7.20	10K	0.120	0.200	0.280	0.014
	15 40	0015	12.8	8.8		50K	7.20	10K	0.120	0.400	0.280	0.014
	15 40	0024	12.7	8.8		50K	7.10	10K	0.130	0.300	0.280	0.012
	15 40	0034	12.7	8.5		50K	7.10	10K	0.130	0.200	0.280	0.012
73/07/11	16 10	0000	30.3		60	55	8.90	14	0.090	0.900	0.080	0.004
	16 10	0005	28.9	8.8		50K	7.90	15	0.080	0.600	0.120	0.003
	16 10	0015	25.8	5.4		55	6.60	15	0.140	0.500	0.210	0.007
	16 10	0030	23.9	2.6		59	6.50	18	0.240	0.500	0.210	0.004
73/09/19	13 55	0000	25.9	8.0	37	56	7.20	16	0.050	0.900	0.070	0.010
	13 55	0010	25.9	7.0		56	6.80	15	0.040	0.400	0.070	0.007
	13 55	0020	25.5	6.2		56	6.60	16	0.050	0.200	0.080	0.007
	13 55	0032	25.2	5.2		58	6.30	15	0.110	0.500	0.130	0.007

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/20

371305
35 41 30.0 080 58 00.0
LAKE NORMAN
37119 NORTH CAROLINA

11EPALES 2111202
3 0038 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/24	15 40	0000	0.073	4.5
	15 40	0006	0.070	
	15 40	0015	0.074	
	15 40	0024	0.079	
	15 40	0034	0.076	
73/07/11	16 10	0000	0.021	3.1
	16 10	0005	0.027	
	16 10	0015	0.024	
	16 10	0030	0.045	
73/09/19	13 55	0000	0.017	13.5
	13 55	0010	0.018	
	13 55	0020	0.018	
	13 55	0032	0.032	

APPENDIX E

TRIBUTARY and WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 75/10/20

3713A1 LS3713A1
35 45 30.0 081 05 25.0
CATAWBA RIVER
37119 7.5 S LAK NORMAN
O/LAKE NORMAN
HWY 73 BRDG .5 MI DSTREAM FROM COWAN DAM
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/25	11 50		0.290	0.200	0.034	0.020	0.025
73/04/15	07 30		0.240	0.440	0.040	0.007	0.025
73/05/14	10 05		0.189	0.420	0.028	0.006	0.020
73/06/23	11 00		0.176	1.680	0.080	0.005K	0.020
73/07/24	15 45		0.046	1.260	0.050	0.005K	0.010
73/08/18	09 30		0.056	0.480	0.017	0.006	0.006
73/10/21	12 30		0.061	0.800	0.065	0.011	
73/11/17	10 30		0.060	0.700	0.056	0.008	0.008
73/12/15	15 30		0.156	0.100	0.044	0.005K	0.015
74/01/06	15 00		0.264	0.100	0.024	0.008	0.015
74/01/19	15 00		0.276	0.900	0.074	0.005K	0.015
74/02/03	16 30		0.224	0.200	0.025	0.005K	0.010
74/02/16	14 50		0.224	0.400	0.015	0.005K	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/20

3713A2 L53713A2
35 43 00.0 081 04 00.0
CATAWBA RIVER
37 MAP CATAWBA CO
I/LAKE NORMAN
US 64-70 BRDG NE CORNER OF CATAWBA
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/25	10 45		0.231	0.280	0.082	0.025	0.055
73/04/15	09 40		0.240	0.320	0.046	0.014	0.050
73/05/19	12 00		0.168	0.270	0.058	0.012	0.045
73/06/23	11 10		0.154	0.360	0.082	0.005K	0.020
73/07/24	13 45		0.176	0.820	0.126	0.011	0.022
73/08/18	10 05		0.147	0.500	0.132	0.007	0.010
73/10/21	12 00		0.126	0.500	0.046	0.011	
73/11/17	09 30		0.140	0.144	0.144	0.012	0.012
73/12/15	14 30		0.160	0.100	0.052	0.008	0.035
74/01/06	10 00		0.264	1.500	0.136	0.024	0.055
74/01/19	14 00		0.320	0.600	0.240	0.020	0.075
74/02/03	14 30		0.232	0.200	0.045	0.015	0.040
74/02/16	15 00		0.224	0.600	0.055	0.015	0.040

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/20

371381 LS371381
35 41 30.0 081 00 00.0
BALL CREEK
37 MAP CATAWBA CO
T/LAKE NORMAN
CATAWBA RD 1819 BRDG 1.7 NW LONG ISLAND
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/25	10 00		0.240	0.110	0.040	0.017	0.035
73/04/15	09 15		0.210	0.230	0.044	0.008	0.025
73/05/19	11 00		0.160	0.110	0.027	0.009	0.020
73/06/23	09 30		0.355	1.540	0.081	0.009	0.030
73/07/24	14 30		0.220	1.200	0.280	0.005K	0.035
73/08/14	09 00		0.170	7.350	1.260	0.009	0.030
73/10/21	10 30		0.150	0.250	0.023	0.015	
73/11/17	10 30		0.064	0.950	0.340	0.005K	0.030
73/12/16	09 15		0.200	0.500	0.060	0.008	0.030
74/01/06	12 00		0.420	1.000	0.068	0.012	0.045
74/01/14	15 00		0.360	0.100K	0.040	0.008	0.020
74/02/03	13 00		0.270	0.300	0.075	0.010	0.050
74/02/16	13 45		0.280	0.200	0.015	0.005	0.060

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/20

3713C1 LS3713C1
35 43 00.0 081 04 30.0
LYLE
37 MAP CATAWBA CO
T/LAKE NORMAN
UNAMED RD BRDG N SIDE TOWN CATAWBA
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/25	10 30		0.410	0.440	0.052	0.023	0.050
73/04/15	09 20		0.340	0.210	0.034	0.023	0.050
73/05/19	11 30		0.330	0.160	0.042	0.024	0.070
73/06/23	09 56		0.410	0.380	0.042	0.024	0.065
73/07/24	14 00		0.440	1.300	0.072	0.032	0.090
73/08/18	09 50		0.380	1.000	0.320	0.024	0.055
73/10/21	11 45		0.320	0.400	0.030	0.044	
73/11/17	09 40		0.200	0.400	0.252	0.032	0.075
73/12/16	15 00		0.140	0.200	0.048	0.005K	0.025
74/01/06	12 30		0.504	1.100	0.060	0.020	0.060
74/01/19	14 30		0.450	0.400	0.068	0.028	0.065
74/02/03	14 00		0.380	0.300	0.030	0.025	0.125
74/02/16	14 30		0.410	0.200	0.025	0.015	0.050

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/20

371301 LS3713D1
35 43 30.0 080 01 30.0
BUFFALO SHOALS CREEK
37 MAP IREDELL CO
T/LAKE NORMAN
RD 1333 BRDG .6 MI E OF US HWY 64-70
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/25	11 00		0.270	0.110	0.025	0.011	0.020
73/04/15	09 50		0.220	0.250	0.029	0.005K	0.020
73/05/19	12 30		0.189	0.100K	0.012	0.008	0.010
73/06/23	12 15		0.260	0.200	0.044	0.009	0.020
73/07/24	13 30		0.430	2.040	0.060	0.046	0.145
73/08/18	10 30		0.273	0.540	0.273	0.005K	0.015
73/10/21	11 15		0.226	0.425	0.026	0.014	
73/11/17	10 10		0.124	0.124	0.124	0.008	0.008
73/12/16	09 50		0.224	0.600	0.036	0.008	0.025
74/01/06	13 20		0.390	0.100K	0.020	0.008	0.030
74/01/19	13 30		0.336	1.100	0.108	0.008	0.020
74/02/03	15 00		0.300	0.360	0.042	0.010	0.050
74/02/16	14 00		0.288	0.330	0.035	0.010	0.060

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/20

3713E1 LS3713E1
35 41 00.0 080 55 30.0
HICKS CREEK
37 MAP IREDELL CO
T/LAKE NORMAN
RD 1322 BRDG 1.6 MI S OF TROUTMAN
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/03/25	09 45		0.315	0.200	0.110	0.064	0.120
73/04/15	09 00		0.300	0.420	0.160	0.088	0.140
73/05/19	08 40		0.410	0.180	0.075	0.115	0.165
73/06/23	09 15		0.370	0.790	0.050	0.126	0.170
73/07/24	15 00		0.380	1.600	0.069	0.054	0.185
73/08/18	10 50		0.380	0.350	0.200	0.180	0.240
73/10/21	10 30		0.490	0.550	0.030	0.500	0.720
73/11/17	14 00		0.430	0.750	0.100	0.300	0.360
73/12/16	13 45		0.410	0.200	0.036	0.148	0.240
74/01/06	14 00		0.450	0.750	0.104	0.084	0.200
74/01/19	14 00		0.520	0.200	0.132	0.120	0.195
74/02/03	15 30		0.340	0.300	0.120	0.100	0.195
74/02/16	13 45		0.352	2.100	0.230	0.020	0.840

STORET RETRIEVAL DATE 75/10/20

3713F1 L3713F1
35 37 00.0 080 50 30.0
UNNAMED CREEK
37 MAP IREDELL CO
T/LAKE NORMAN
US HWY 21 BRDG 1 MI S OF MOORESVILLE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/04/15	09 00		0.350	0.320	0.027	0.013	0.050
73/05/14	09 12		0.105	0.400	0.015	0.012	0.050
73/06/23	10 15		0.035	2.600	0.058	0.013	0.075
73/07/24	15 30		0.032	0.800	0.014	0.016	0.050
73/08/14	10 00		0.315	1.050	0.090	0.126	0.142
73/10/21	11 30		0.250	0.700	0.039	0.029	
73/11/17	11 40		0.042	0.390	0.036	0.016	0.085
73/12/16	14 30		0.290	0.500	0.084	0.016	0.045
74/01/06	14 30		0.528	0.300	0.060	0.016	0.045
74/01/14	14 45		0.528	0.200	0.060	0.020	0.060
74/02/03	15 00		0.308	0.700	0.390	0.025	0.123
74/02/16	14 15		0.410	1.200	0.100	0.025	0.375

STORET RETRIEVAL DATE 75/11/17

3713CA AS3713CA P002606
35 43 00.0 081 13 30.0
CONOVER NC
37 CATAWBA CO HWY M
T/LAKE NORMAN
LYLE CREEK
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/11/30	10 00		26.000	6.900	0.680	10.200	11.500	0.200	0.200
73/12/27	22 00		12.000	1.200	0.054	3.570	4.300	0.200	0.180
74/01/29	10 30		8.200	1.100	0.140	2.880	4.600	0.100	0.473
74/02/27	11 00		14.300	2.300	0.110	5.400	5.800	0.090	0.080
74/03/30	21 00		8.100	1.700	0.085	2.900	3.900	0.090	0.080
74/04/29	09 15		5.280	5.500	0.440	6.400	7.600	0.140	0.090
74/05/30	10 00		1.760	2.500	0.050K	4.800	5.400	0.180	0.270
74/06/28	23 00		0.056	15.000	3.100	4.800	6.600	0.310	0.250
74/07/29	10 45		0.270	13.000	2.500	2.800	4.100	0.350	0.190
74/08/29	10 30		0.120	10.000		0.110	13.000	0.200	0.758
74/10/28	09 30		9.200	3.400	0.110	6.750	7.200	0.310	0.790

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/11/17

3713GA AS3713GA P000800
35 41 30.0 080 53 30.0
TROUTMAN NC
37 IREDELL CO HWY M
1/LAKE NORMAN
BIG BRANCH
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/05/22	16 30		0.280	34.000	15.400	10.400	13.900	0.050	0.050
73/06/22	13 00		0.200	17.600	3.500	13.600	15.700	0.050	0.050
73/07/25	15 00		4.900	5.900	1.900	4.500	6.600	0.060	0.050
73/11/27			9.750	8.600	0.048	12.600	15.000	0.060	0.060
74/03/05	16 00		1.000	24.000	8.850	9.600	13.500	0.060	0.065
74/04/04	10 00		2.500	18.000	5.300	5.300	8.200	0.060	0.040
74/06/24	12 00		5.416	16.000	3.950	7.500	9.900	0.066	0.060
74/09/16			1.000	20.000	5.900	9.300	10.500	0.060	0.060
74/09/23	13 00		4.500	17.500	7.750	9.200	12.000	0.050	0.150

STORET RETRIEVAL DATE 75/11/17

3713XA TF3713XA P001295
35 28 30.0 080 49 08.0
CORNELIUS
37 250 CHARLOTTE
T/LAKE NORMAN
UNNAMED CREEK
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/06/19	11 00		0.070	47.900	28.000	10.500	14.700	0.206	0.190
73/07/27	09 30		0.100	37.000	9.900	0.810	6.120	0.206	0.189
73/08/17	10 20		0.040	44.000	7.600	4.300	5.500	0.206	0.190
73/09/19	14 45		3.200	33.700	20.200	9.100	12.500	0.206	0.190
73/10/18	10 00		0.031	37.000	21.000	7.700	9.600	0.206	0.189
73/11/19	09 40		0.040	38.000	22.000	8.500	10.500	0.206	0.190
73/12/19	10 40		0.270	42.000	16.000	7.200	11.000	0.206	0.190
74/01/17	10 40		0.080	37.500	15.200	6.200	9.500	0.206	0.190
74/02/19	11 40		0.520	21.000	8.400	3.500	5.600	0.206	0.190
74/03/19	10 00		0.080	29.000	16.500	8.400	11.500	0.206	0.190
74/04/19	10 30		0.080	31.000	23.000	7.900	14.000	0.206	0.190
74/05/17	11 00		0.200	37.000	17.300	8.800	13.500	0.206	0.190